[Supplementary Information]

Giant Dzyaloshinskii-Moriya interaction in Rashba superlattices

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Magnetic anisotropy of superlattices in terms of FM thickness

First of all, the Co thickness dependence of effective magnetic anisotropy (K_{eff}) and DMI are investigated in [Co(t)/Pt(0.4)]$_5$, [Co(t)/Pd(0.4)]$_5$, and [Co(t)/Pd(0.4)/Pt(0.4)]$_5$-SL. The K_{eff} is obtained from areal difference between easy and hard axis magnetization curves (see **Fig S1 (a)-(c)**). We note that the K_{eff} of [Co/Pd/Pt]-SL is larger than those of other SLs only when $t_{\text{Co}}<\sim0.5$ nm (see **Fig. S1 (d)**), and found that this is related to a transition from the *coherent* strain regime to the *incoherent* strain regime, observed in the $t_{\text{Co}}K_{\text{eff}}$ vs. t_{Co} plots (**Fig. S1(e)**). In general, the transition from positive to negative slope of the $t_{\text{Co}}K_{\text{eff}}$ vs. t_{Co} plots generally occurs within the thickness range due to the strain relaxation. Here, we note that in the coherent regime with the positive slope, anisotropy of the [Co/Pd/Pt]-SL is more than two-folds larger than that of others while anisotropies of both the [Co/Pt]-SL and the [Co/Pd/Pt]-SL becomes similar to each other in the incoherent regime. In other words, ABC-type structure shows exceptionally larger K_{eff} only in the coherent strain regime. A possible origin of such large anisotropy in the [Co/Pt/Pd]-SL is bulk spin momentum locking arising from the symmetry breaking due to odd contribution of magnetic anisotropy energy. An additional energy gap between the occupied and unoccupied states is driven by the symmetry breaking in band structures. Here, the additional energy gap contributes to the total energy gap, depending on the sign of k. Our result shows that the superlattice with the symmetry breaking should be in the coherent strain regime to have the k-dependent energy gap in its band structure.
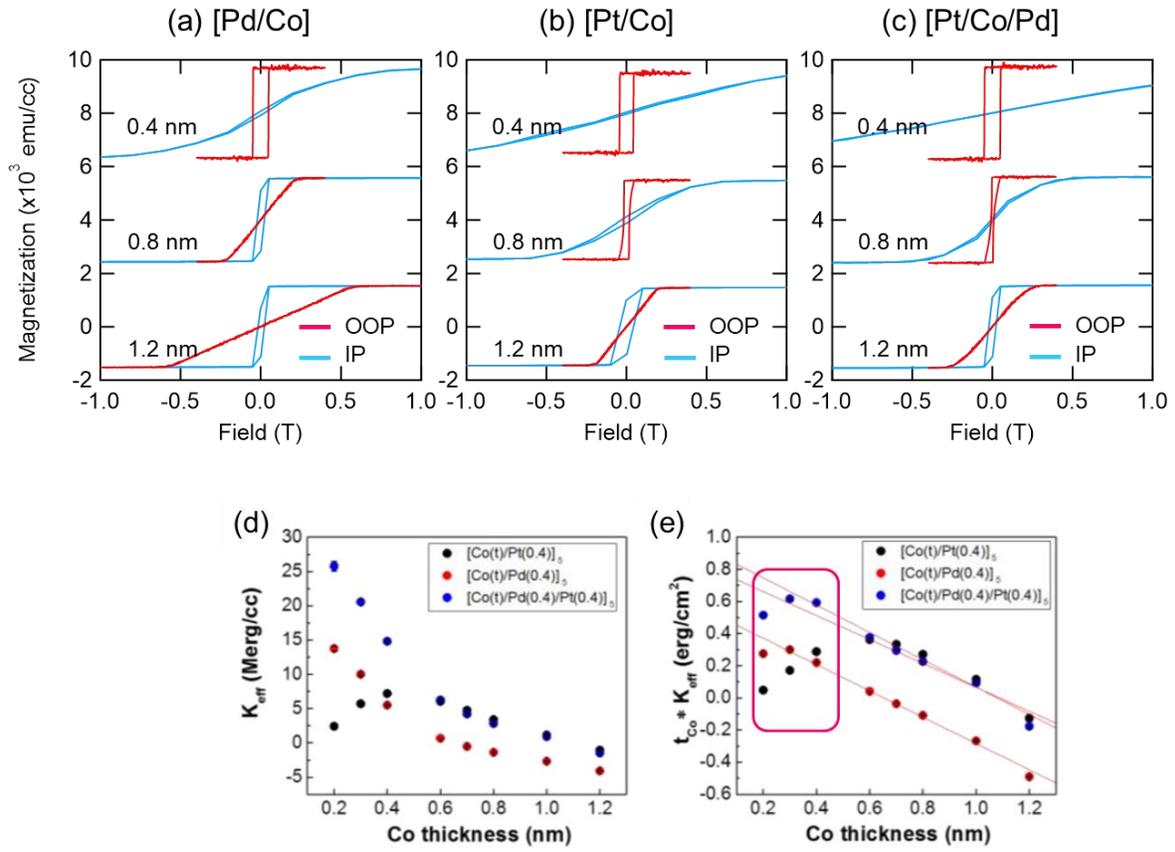
Figure S1. Easy and hard axis M-H curves of (a) [Pd/Co], (b) [Pt/Co], and (c) [Co/Pd/Pt]-SL. (d) K_{eff} and $t·K_{eff}$ plots in terms of Co thickness